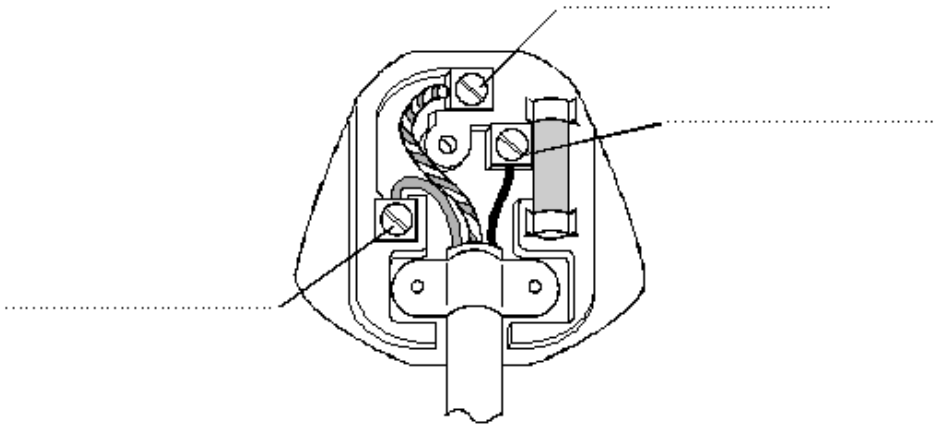
Q1. The diagram shows the inside of a mains plug.

(a) Label the earth, live and neutral pins.



(3)

(b) (i) Explain how the earth wire and the fuse protect a person from an electric shock when there is a short circuit to the metal case of an appliance.

.....

.....

.....

.....

.....

.....

(4)

(ii) What is the most appropriate size fuse rating for a fuse in a television?

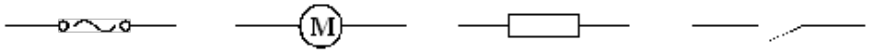
Circle the correct answer.

3 A 5 A 13 A

(1)
(Total 8 marks)

Q2. In a hairdryer circuit there is a heater and a motor. It is important that the motor is always running when the heater is switched on.

(a) Using the symbols shown below only **once** each, draw a circuit for a hairdryer.



(2)

(b) Modern hairdryers are described as *double insulated.*

Explain what this term means.

.....

.....

.....

(2)

(c) On a modern hairdryer handle it states:

1600 W 230 V 50 Hz

(i) [A] Write an equation which shows the relationship between current, power and voltage.

.....

(1)

[B] Calculate the current in the hairdryer when it is on full power.
Show clearly how you get your answer.

.....

.....

Current = ... A

(2)

(ii) [A] Write an equation which shows the relationship between current, resistance and voltage.

.....

(1)

[B] The resistance of the heater is 20 ohms. Calculate the resistance of the motor.

Show clearly how you get your answer.

.....

.....

Resistance = ... ohms

(2)
(Total 10 marks)

Q3. (i) Write the equation which shows the relationship between the electric *current*, the *power* and the *voltage*.

.....

.....

(1)

(ii) Calculate the power if the current is 5 A and the voltage is 400 000 V. Show clearly how you work out your answer and give the unit.

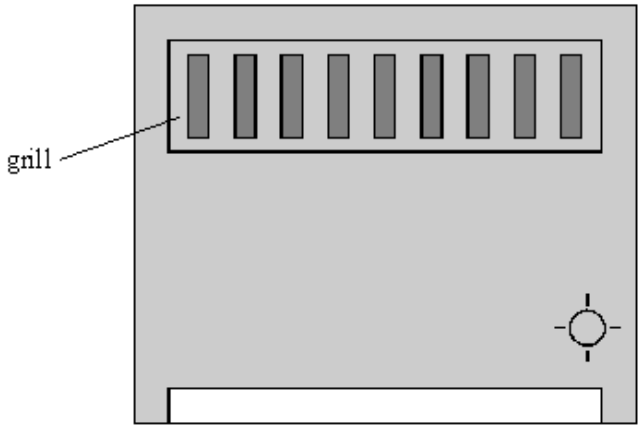
.....

.....

Power = ...

(2)
(Total 3 marks)

Q4. The diagram shows a fan heater.



(a) Complete this sentence.

The fan heater is designed to transfer electrical energy as .....

energy and ..... energy.

(2)

(b) The fan heater is connected to the mains by a three core cable.

(i) Why are the wires in the cable made out of copper?

.....

(ii) Why are the wires in the cable covered by plastic?

.....

(2)

(c)

You may find this equation useful when answering this part of the question **energy transferred (kWh) = power (kilowatt, kW) × time (hour, h)**

(i) The power of the fan heater is 2.75 kW.
Calculate how many kilowatt hours (kWh) of energy are transferred when the fan heater is used for 6 hours.

.....

.....

Number of kilowatt hours .....

(2)

(ii) How much will it cost to use the fan heater for 6 hours if one Unit of electricity costs 7p?

.....

.....

Cost ..... p

(2)

(d) A fault caused a much higher than normal current to flow in the heater.
Describe what happened to the wire in the fuse.

.....

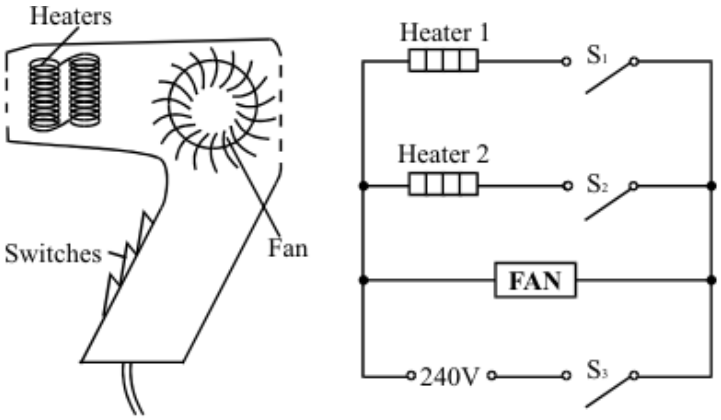
.....

.....

(2)

(Total 10 marks)

Q5. The diagrams show a hair-dryer and the circuit inside the hair-dryer.



(a) Switches S_1, S_2 and S_3 are all shown in the **OFF** position.

Which switch or switches have to be **ON** to make:

(i) only the fan work? .....

(ii) both heaters work? .....

(2)

(b) (i) What happens to the current in the circuit when the heaters are switched on?

.....

(ii) Suggest why it is important to have the fan working when the heaters are switched on.

.....

.....

.....

(3)

(c) This hair-dryer has a plastic case. It is connected to a mains socket by a 3-pin plug. The cable connecting the hair-dryer to the plug contains only two wires.

(i) Write down the colour of the insulation on the wires.

Wire 1 .....

Wire 2 .....

(ii) Which of the usual three wires is **not** needed?

.....

(iii) This hair-dryer is safe to use without the third wire. Explain why.

.....

.....

.....

(5)

(d) The following information is stamped on the hair-dryer.

(i) Which number tells us how fast the hair-dryer uses energy?

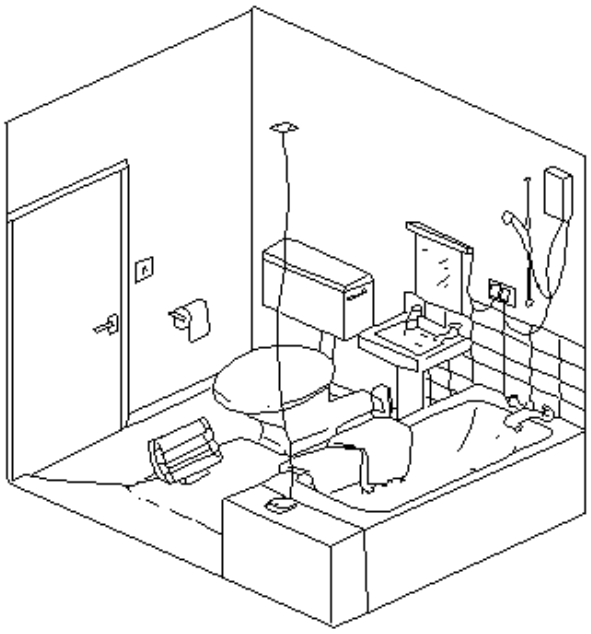
.....

(ii) On what else does the energy used by the hair-dryer depend?

.....

(2)
(Total 12 marks)

Q6. (a) The picture below shows the bathroom in a house.



Describe **three** examples of dangerous practice in the use of mains electricity in this bathroom.

1. .....

.....

2. .....

.....

3. .....

.....

(3)

(b) In the table below three electrical appliances are listed with their power ratings and the number of hours they are used each week.

ELECTRICAL APPLIANCE	POWER RATINGS (W)	TIME USED EACH WEEK (h)	k Wh USED EACH WEEK
TV	200	35	
Kettle	2000	2	
Toaster	1000	1	
Cooker	11 500	7	

(i) Complete the table by inserting the number of kWh used by each appliance each week.

(ii) Which appliance would cost the least to run per week?

.....

(iii) The cost of running a toaster is 8p per week. How much does it cost to run the kettle each week?

.....

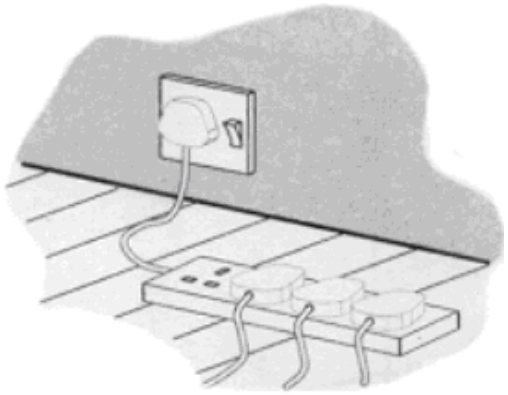
.....

.....

(6)

(Total 9 marks)

Q7. (a) An adaptor can be used to connect up to four appliances in parallel to one 230 V mains socket. The adaptor is fitted with a 13 A fuse. The table gives a list of appliances and the current they draw from a mains socket.



Appliance	**Current**
computer	1 A
hairdryer	4 A
heater	8 A
iron	6 A
television	2 A

(i) What current will flow to the adaptor when the television, computer and hairdryer are plugged into the adaptor?

.....

Current = ... A

(1)

(ii) Write down the equation which links current, electrical power and voltage.

.....

(1)

(iii) Calculate the electrical power used when the television, computer and hairdryer are plugged into the adaptor. Show clearly how you work out your answer and give the unit.

.....

.....

.....

Electrical power = ...

(2)

(iv) What would happen to the fuse if the heater is also plugged into the adaptor?

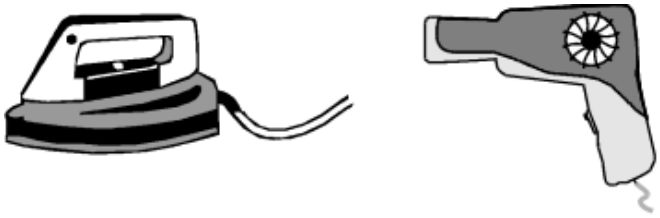
Give a reason for your answer.

.....

.....

(2)

(b) The diagram shows **two** of the appliances.



Iron Hairdryer

(i) For safety reasons, it is important that the iron has an earth wire connected to its outer metal case. Explain why.

.....

.....

.....

.....

(2)

(ii) The hairdryer does not have an earth wire. It is safe to use because it is double *insulated.* Explain what the term *double insulated* means.

.....

.....

.....

.....

(2)

(Total 10 marks)

Q8. The information plate on a hairdrier is shown.

(a) What is the power rating of the hairdrier?

.....

(1)

(b) (i) Write down the equation which links current, power and voltage.

.....

(1)

(ii) Calculate the current in amperes, when the hairdrier is being used. Show clearly how you work out your answer.

.....

.....

.....

.....

Current = ... amperes

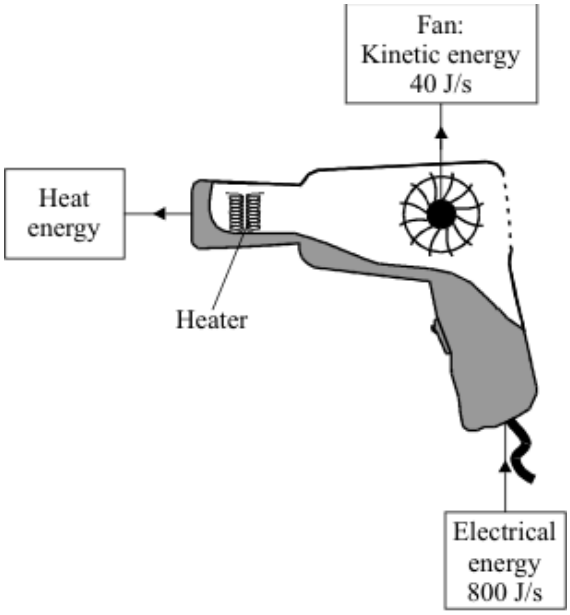
(2)

(iii) Which **one** of the following fuses, 3A, 5A or 13A, should you use with this hairdrier?

.....

(1)

(c) The hairdrier transfers electrical energy to heat energy and kinetic energy.



Use the following equation to calculate the efficiency of the hairdrier in transferring electrical energy into heat energy.

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

.....

.....

.....

Efficiency = ...

(2)

(d) One kilowatt-hour of electricity costs 6p. Use the following equation to calculate how much it will cost to use the hairdrier for 10 minutes.

cost of electricity = energy transferred × price per unit

.....

.....

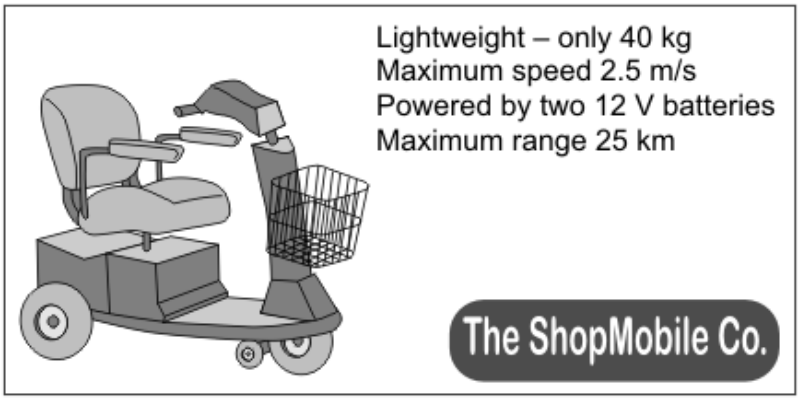
.....

Cost = ...

(2)

(Total 9 marks)

Q9. The picture shows an advert for an electric mobility scooter.



(a) The batteries are joined in series.

(i) What is the potential difference provided by the batteries to the motor?

.....

(1)

(ii) The batteries supply a *direct current (d.c.)*.

What is a *direct current (d.c.)*?

.....

.....

(1)

(b) At 2.5 m/s on flat ground, the motor takes a current of 3.0 A from the batteries.

(i) Explain why a bigger current is taken from the batteries when the scooter is going uphill at 2.5 m/s.

.....

.....

.....

.....

(2)

(ii) What effect does travelling uphill have on the range of the scooter?

.....

(1)

(c) The mass of the scooter driver is 80 kg.

Use the equation in the box to calculate the kinetic energy of the scooter **and** driver when they are travelling at maximum speed.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Q10. **Diagram 1** shows a hairdryer.
Diagram 2 shows how the heaters and fan of the hairdryer are connected to a 3-pin plug.
The hairdryer does not have an earth wire.

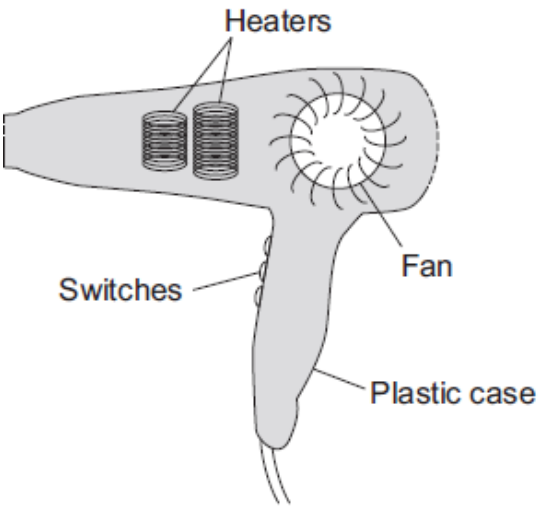


Diagram 1

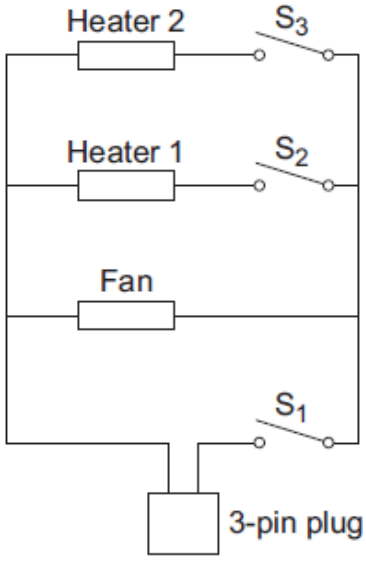


Diagram 2

(a) What colour is the insulation around the wire connected to the live pin inside the plug?

.....

(1)

(b) Why does the hairdryer **not** need an earth wire?

.....

.....

(1)

(c) All the switches are shown in the OFF position.

(i) Which switch or switches have to be ON to make:

(1) only the fan work; .....

(2) heater 2 work? .....

(2)

(ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

.....

.....

.....

.....

.....

(2)

(d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Use the equation in the box to calculate the maximum power of the hairdryer.

power = current × potential difference

Show clearly how you work out your answer and give the unit.

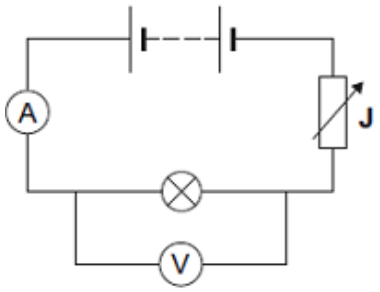
.....

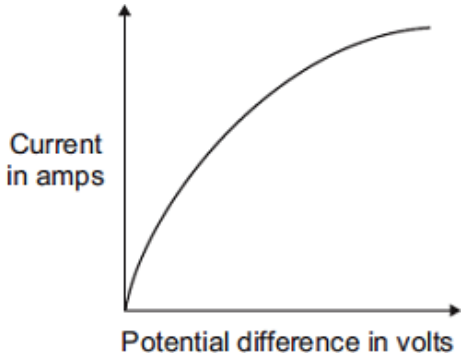
.....

Maximum power = ...

(3)
(Total 9 marks)

Q11. (a) The diagram shows the circuit used to obtain the data needed to plot the current–potential difference graph for a filament bulb.





(i) Why is the component labelled '**J**' included in the circuit?

.....

.....

(1)

(ii) The resistance of the bulb increases as the potential difference across the bulb increases. Why?

.....

.....

(1)

(iii) The bulb is at full brightness when the potential difference across the bulb is 12 V. The current through the bulb is then 3 A.

Calculate the power of the bulb when it is at full brightness and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power = ...

(3)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10%	£1.95	2 000
Light Emitting Diode (LED)	32%	£11.70	36 000

Both types of light bulb produce the same amount of light.

Evaluate, in terms of cost and energy efficiency, the use of the two types of light bulb.

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

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(6)
(Total 11 marks)